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2003 -10- 06

Huvudfaxen Kassan

Method and arrangement in a telecommunication system

FIELD OF THE INVENTION

The present invention relates to methods and arrangements in a mobile 3rd generation communication system and user equipments intended for usage in such systems. It relates in particular to an efficient handling of an uplink channel for transmitting of control information related to the Multimedia Broadcast Multicast Service (MBMS).

MBMS is a service for transmitting data from a single source entity to multiple recipients in the downlink. There are two modes of operation defined, the broadcast and the multicast mode. The service is considered to be a "best-effort" service, e.g. with no requirements for retransmissions in case on lost data. Therefore, no uplink has been considered, e.g., for transmission of acknowledgements of receipts.

SUMMARY OF THE INVENTION

Especially when considering a very large number of users of an MBMS-service within the same limited geographical area, e.g. thousands of users at a sports arena, the introduction of an MBMS-uplink channel implies the problem that the radio interface between said users and the network system is not capable to support such an uplink/feedback channel for each of the user equipments. However, said feedback will be necessary, inter alia, to allow a correct billing of the user equipments.

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The current uplink channel structure is not designed for a large number of users starting simultaneously to send feedback messages. Thus, when using the normal RACH uplink channel, which is based on a slotted ALOHA-scheme, as an MBMS-uplink channel all receptions will collide with their transmissions making it thus impossible for any user to use the uplink channel. In scenarios with a large number of user equipments this will prevent the system from utilising a charging that bases on volume of content of MBMS-data messages that have been sent to a user equipment.

The solution according to the present invention suggests a division of an MBMS-session into a "MBMS-data transfer period" and a "MBMS-data acknowledgement period". This implies a spreading of the downlink transmission of MBMS-data messages and the uplink transmission of acknowledgements for received MBMS-data messages in order to minimise collisions of user equipments on the uplink channel. Spreading can be performed over at least one of the parameters time, RACH sub-channels, and RACH-signatures.

It is an advantage of the present invention that collisions can be avoided when sending volume based MBMS-acknowledgement messages by preventing all user equipments to start transmissions at the same time.

It is another advantage of the present invention that MBMS-acknowledgements do not interfere with other normal non-MBMS related uplink activities.

It is yet another advantage of the present invention that the network has control of the amount of collisions that should be allowed for MBMS-acknowledgements.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an example from 3GPP TR 25.922 v3.7.0 of FDD RACH/PRACH configurations in a cell.

Figure 2 shows an example of MBMS-acknowledgements that are spread over time.

Figure 3 shows a first alternative for spreading MBMS-acknowledgements over time.

Figure 4 shows a second alternative for spreading MBMS-acknowledgements over time.

Figure 5 shows a third alternative for spreading MBMS-acknowledgements over time.

DETAILED DESCRIPTION

The current usage of the common uplink channel (RACH) that is supported by all user equipments is based on a slotted ALOHA-scheme with random selection of available channels. The current RACH-configuration possibilities are illustrated by figure 1. In the example of figure 1 there are four physical RACH channels with a number of signatures and sub-channels available for each of them. The present invention suggests a grouping, or partition, of a signature and sub-channel space. These portions are assigned to user equipments according to the priority of the transmission for a particular service or according to the priority of the user equipment itself.

When a user equipment uses the RACH, it randomly picks a signature and sub-channel among the partitions, which it is allowed to use, and uses this as basis for the transmission of a RACH-message. If there is a collision, i.e. several

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user equipments picking the same preamble and sub-channel at a time, the user equipment will wait for a random time and then try again. This random time scheme works in normal cases when a large number of user equipments does not use the channel at the same time or if they are not synchronised in the beginning of the RACH usage.

In the MBMS acknowledgement scenario, however, a very large number of user equipments will cause collisions constantly from the start. This is because all user equipments receiving MBMS-data gets the last part of that MBMS-data at the same time and also starts, as a consequence, sending the acknowledgement of that MBMS-data all at the same time. In addition to this all user equipments using an MBMS-service and sending acknowledgements will interfere with other user equipments, which do not use an MBMS-service, that try to access the network.

Therefore, the basic part of the present invention is a division of an MBMS-session into several parts in order to make the transmission of acknowledgements possible. The first part is the "MBMS-data transfer period". During this period all MBMS user equipments receive data. Then follows the "MBMS-data acknowledgement period" during which the user equipments that have received MBMS-data messages send acknowledgement messages. Thus, the basic idea of the present invention is a separation, i.e. a spreading as described above, of the transmission of MBMS-data and the acknowledgement of received MBMS-data in order to avoid collisions. Figure 2 shows an example of a signalling flow demonstrating a spreading over time of MBMS-acknowledgements.

The following will describe three alternative embodiments to perform the idea according to the present invention.

Figure 3 describes a first alternative of a time-spreading of MBMS-acknowledgements. In order to avoid that all user equipments transmit the RACH-message including the MBMS-acknowledgement message at the same time, the user equipment determines a random waiting time. Then, the user equipment will wait during this time until it starts to send the MBMS-acknowledgement message.

Figure 4 describes a second alternative for time-spreading of MBMS-acknowledgements. In order to avoid that all user equipments transmit the RACH-message including the MBMS-acknowledgement message at the same time, the user equipments start sending the acknowledgements at different times. As shown in the example of figure 4, the user equipment UE1 starts at a time T1 while the user equipment UE2 starts at a different time T2. This will prevent the acknowledgements on the RACH-channel from collisions. The time for starting the acknowledgement message is assigned to each of the user equipments and could be based, e.g., on the UE-identity or could be assigned to the user equipment individually when participating in an MBMS-session. Another possibility would be to determine this time depending on the time when the user equipment has sent the latest MBMS-acknowledgement. However, this alternative still implies the possibility that several user equipments start sending acknowledgement messages at the same time as long as the number of user equipments is not too big.

Figure 5 shows yet another alternative for time-spreading of MBMS-acknowledgements. According to this alternative the user equipments start sending acknowledgement messages at different times and on different sub-channels and using different signatures. In the example shown in figure 5, the user equipment UE1 starts at a time T1 and using a signature 15 and sub-channel 11. The user equipment UE2 starts also at

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time T1 and using signature 15 but sub-channel 10. At time T2 the signature and sub-channel positions can be fully re-used again. This will prevent collisions and facilitates for the UTRAN to know which user equipment is transmitting at a certain signature/sub-channel. Also this alternative implies the possibility that several user equipments start sending acknowledgement messages at the same time as long as the number of user equipments is not too big.

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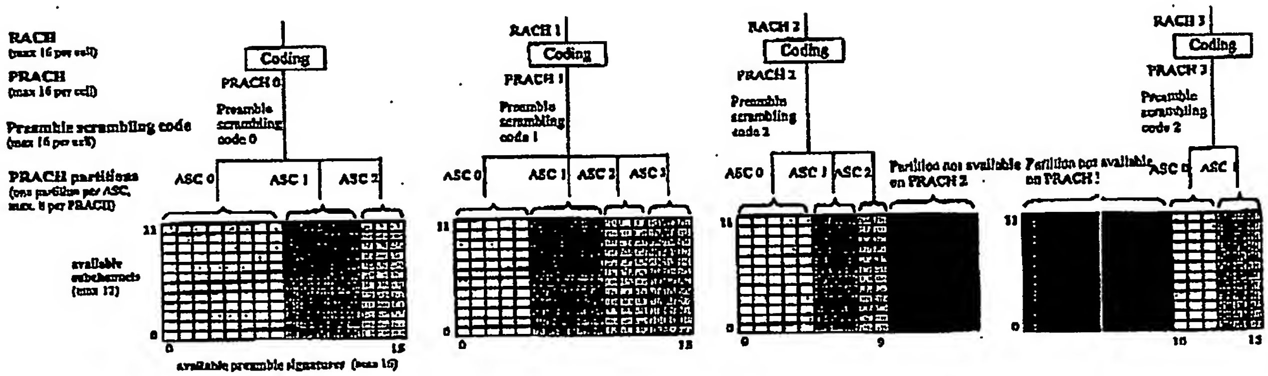

Figure 1

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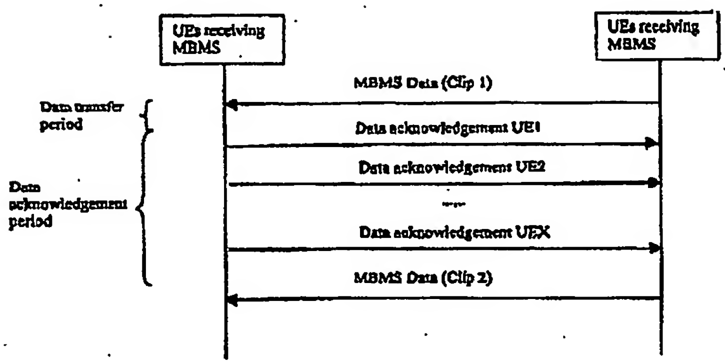

Figure 2

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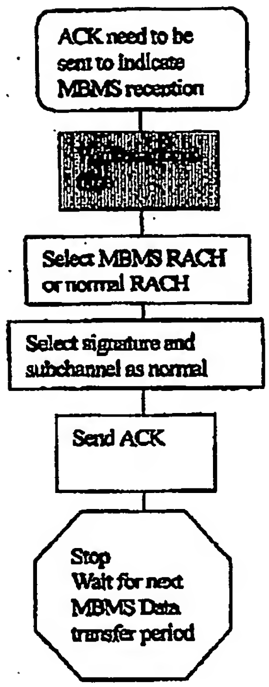

Figure 3

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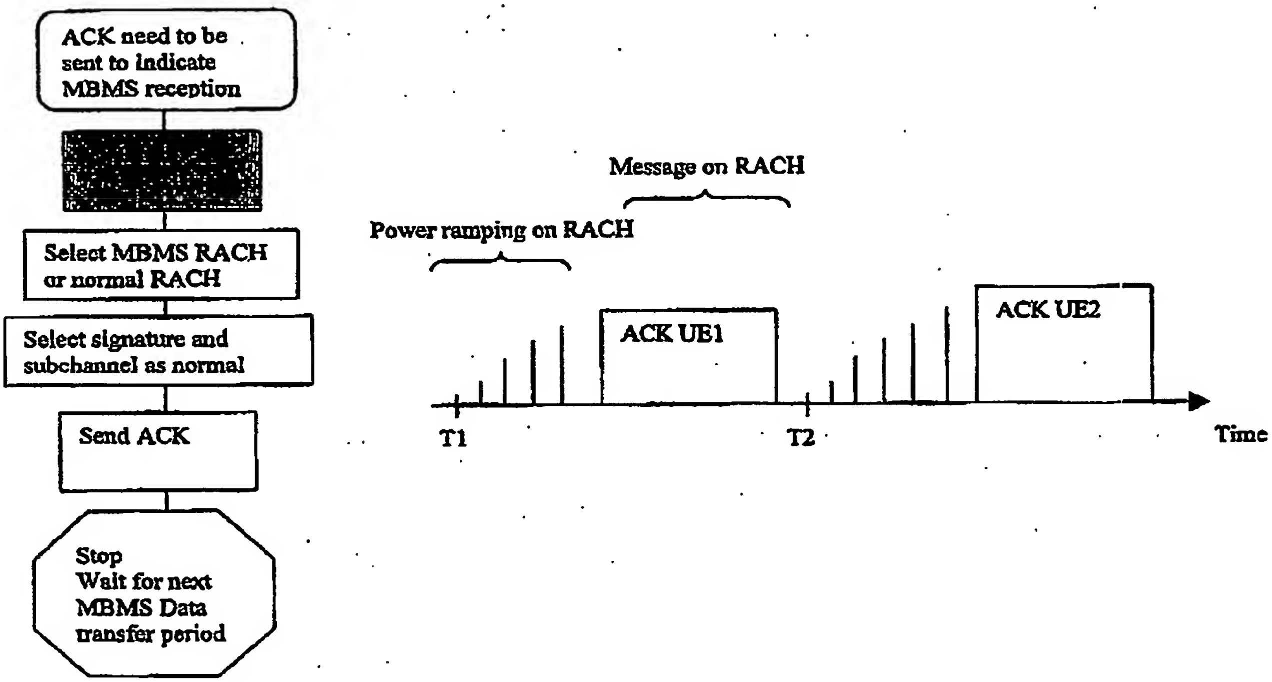

Figure 4

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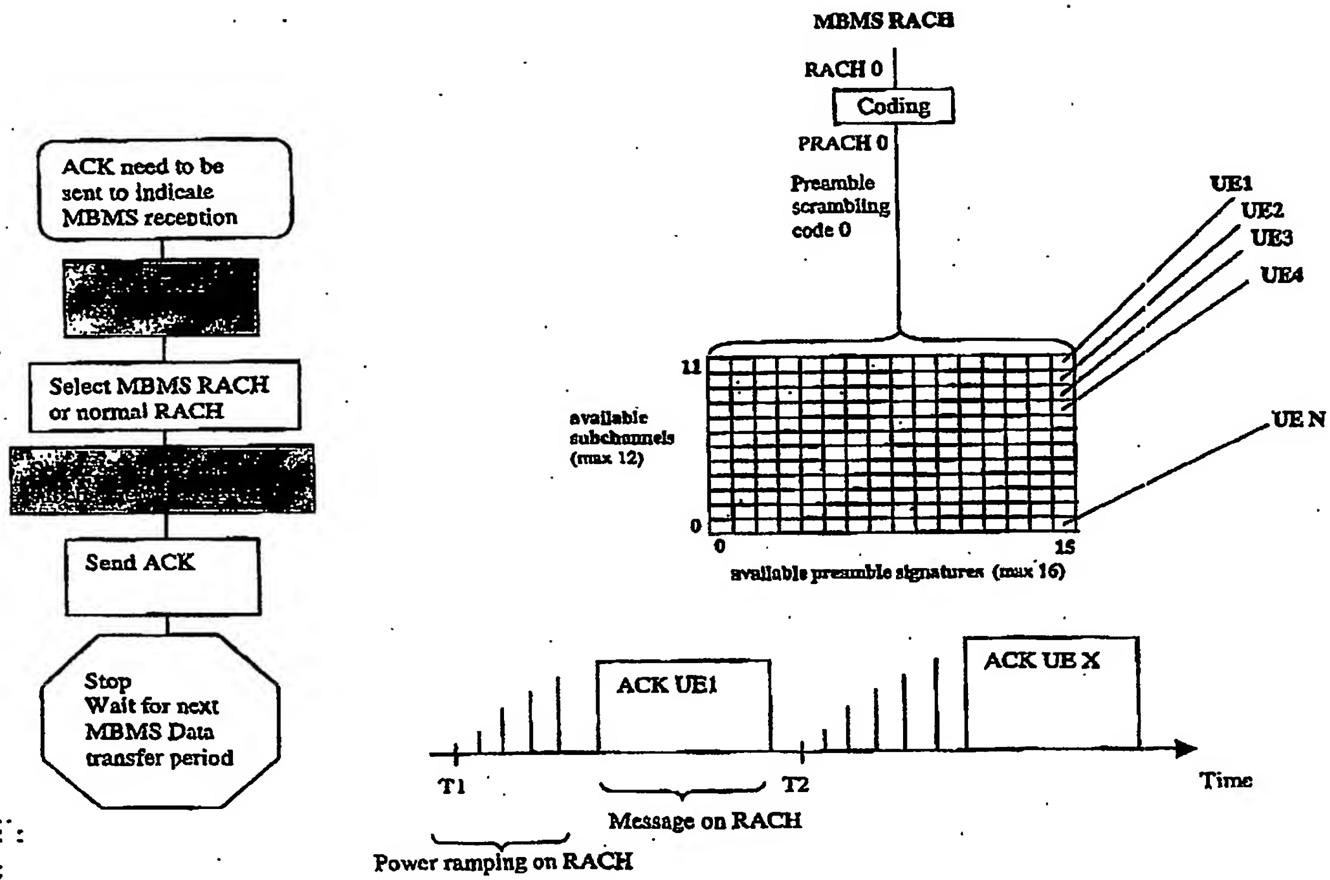

Figure 5

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